

## CLAIMS

1. (currently amended) A method for synthesizing an auditory scene, comprising:  
processing at least one input channel to generate two or more processed input signals;  
filtering the at least one input channel to generate two or more diffuse signals; and  
combining the two or more diffuse signals with the two or more processed input signals to  
generate a plurality of output channels for the auditory scene, wherein processing the at least one input  
channel comprises:  
converting the at least one input channel from a time domain into a frequency domain to  
generate a plurality of frequency-domain (FD) input signals;  
delaying the FD input signals to generate a plurality of delayed FD signals; and  
scaling the delayed FD signals to generate a plurality of scaled, delayed FD signals.

2. (canceled)

3. (currently amended) The invention of claim [[2]] 1, wherein:  
the FD input signals are delayed based on inter-channel time difference (ICTD) data; and  
the delayed FD signals are scaled based on inter-channel level difference (ICLD) and inter-  
channel correlation (ICC) data.

4. (original) The invention of claim 3, wherein:  
the at least one input channel is at least one combined channel generated by performing binaural  
cue coding (BCC) on an original auditory scene; and  
the ICTD, ICLD, and ICC data are cue codes derived during the BCC coding of the original  
auditory scene.

5. (original) The invention of claim 4, wherein the at least one combined channel and the  
cue codes are transmitted from an audio encoder that performs the BCC coding of the original auditory  
scene.

6. (original) The invention of claim 3, wherein different ICTD, ICLD, and ICC data are  
applied to different frequency sub-bands of the corresponding FD signals.

7. (currently amended) The invention of claim [[2]] 1, wherein:  
the diffuse signals are FD signals; and

3 the combining comprises, for each output channel:  
4 summing one of the scaled, delayed FD signals and a corresponding one of the FD  
5 diffuse input signals to generate an FD output signal; and  
6 converting the FD output signal from the frequency domain into the time domain to  
7 generate the output channel.

1 8. (original) The invention of claim 7, wherein filtering the at least one input channel  
2 comprises:  
3 applying two or more late reverberation filters to the at least one input channel to generate a  
4 plurality of diffuse channels;  
5 converting the diffuse channels from the time domain into the frequency domain to generate a  
6 plurality of FD diffuse signals; and  
7 scaling the FD diffuse signals to generate a plurality of scaled FD diffuse signals, wherein the  
8 scaled FD diffuse signals are combined with the scaled, delayed FD input signals to generate the FD  
9 output signals.

1 9. (original) The invention of claim 8, wherein:  
2 the FD diffuse signals are scaled based on ICLD and ICC data;  
3 the at least one input channel is at least one combined channel generated by performing BCC  
4 coding on an original auditory scene; and  
5 the ICLD and ICC data are cue codes derived during the BCC coding of the original auditory  
6 scene.

1 10. (original) The invention of claim 9, wherein the at least one combined channel and the  
2 cue codes are transmitted from an audio encoder that performs the BCC coding of the original auditory  
3 scene.

1 11. (original) The invention of claim 9, wherein different ICLD and ICC data are applied to  
2 different frequency sub-bands of the corresponding FD signals.

1 12. (original) The invention of claim 7, wherein filtering the at least one input channel  
2 comprises:  
3 applying two or more FD late reverberation filters to the FD input signals to generate a plurality  
4 of diffuse FD signals; and

5 scaling the diffuse FD signals to generate a plurality of scaled diffuse FD signals, wherein the  
6 scaled diffuse FD signals are combined with the scaled, delayed FD input signals to generate the FD  
7 output signals.

1 13. (original) The invention of claim 12, wherein:  
2 the diffuse FD signals are scaled based on ICLD and ICC data;  
3 the at least one input channel is at least one combined channel generated by performing BCC  
4 coding on an original auditory scene; and  
5 the ICLD and ICC data are cue codes derived during the BCC coding of the original auditory  
6 scene.

1 14. (original) The invention of claim 13, wherein different ICLD and ICC data are applied  
2 to different frequency sub-bands of the corresponding FD signals.

1 15. (currently amended) The invention of claim 1, wherein the method generates more than  
2 two output channels from the at least one input channel.

1 16. (original) The invention of claim 15, wherein the method synthesizes a surround sound  
2 auditory scene.

1 17. (original) The invention of claim 15, wherein a single input channel is used to  
2 synthesize the auditory scene.

1 18. (original) The invention of claim 1, wherein:  
2 the method applies the processing, filtering, and combining for input channel frequencies less  
3 than a specified threshold frequency; and  
4 the method further applies alternative auditory scene synthesis processing for input channel  
5 frequencies greater than the specified threshold frequency.

1 19. (original) The invention of claim 18, wherein the alternative auditory scene synthesis  
2 processing involves coherence-based BCC coding without the filtering that is applied to the input  
3 channel frequencies less than the specified threshold frequency.

1 20. (canceled)

1           21.     (currently amended) Apparatus for synthesizing an auditory scene, comprising:  
2           a configuration of at least one time domain to frequency domain (TD-FD) converter and a  
3           plurality of filters, the configuration adapted to generate two or more processed FD input signals and two  
4           or more diffuse FD signals from at least one TD input channel;  
5           two or more combiners adapted to combine the two or more diffuse FD signals with the two or  
6           more processed FD input signals to generate a plurality of synthesized FD signals; and  
7           two or more frequency domain to time domain (FD-TD) converters adapted to convert the  
8           synthesized FD signals into a plurality of TD output channels for the auditory scene, wherein:  
9           the configuration comprises:  
10                 a first TD-FD converter adapted to convert the at least one TD input channel into  
11                 a plurality of FD input signals;  
12                 a plurality of delay nodes adapted to delay the FD input signals to generate a  
13                 plurality of delayed FD signals; and  
14                 a plurality of multipliers adapted to scale the delayed FD signals to generate a  
15                 plurality of scaled, delayed FD signals; and  
16                 the combiners are adapted to sum, for each output channel, one of the scaled, delayed FD  
17                 signals and a corresponding one of the diffuse FD signals to generate one of the synthesized FD signals.

1           22.     (canceled)

1           23.     (currently amended) The invention of claim [[22]] 21, wherein:  
2           the delay nodes are adapted to delay the FD input signals based on inter-channel time difference  
3           (ICTD) data; and  
4           the multipliers are adapted to scale the delayed FD signals based on inter-channel level  
5           difference (ICLD) and inter-channel correlation (ICC) data.

1           24.     (original) The invention of claim 23, wherein:  
2           the at least one input channel is at least one combined channel generated by performing binaural  
3           cue coding (BCC) on an original auditory scene; and  
4           the ICTD, ICLD, and ICC data are cue codes derived during the BCC coding of the original  
5           auditory scene.

1           25.     (original) The invention of claim 23, wherein the configuration is adapted to apply  
2           different ICTD, ICLD, and ICC data to different frequency sub-bands of the corresponding FD signals.

1           26.     (canceled)

1           27.     (currently amended) The invention of claim [[26]] 21, wherein  
2           each filter is a TD late reverberation filter adapted to generate a different TD diffuse channel  
3           from the at least one TD input channel;  
4           the configuration comprises, for each output channel in the auditory scene:  
5                 another TD-FD converter adapted to convert a corresponding TD diffuse channel into an  
6           FD diffuse signal; and  
7                 an other multiplier adapted to scale the FD diffuse signal to generate a scaled FD diffuse  
8           signal, wherein a corresponding combiner is adapted to combine the scaled FD diffuse signal with a  
9           corresponding one of the scaled, delayed FD signals to generate one of the synthesized FD signals.

1           28.     (original) The invention of claim 27, wherein:  
2           each other multiplier is adapted to scale the FD diffuse signal based on ICLD and ICC data;  
3           the at least one input channel is at least one combined channel generated by performing BCC  
4           coding on an original auditory scene; and  
5           the ICLD and ICC data are cue codes derived during the BCC coding of the original auditory  
6           scene.

1           29.     (original) The invention of claim 28, wherein the configuration applies different ICLD  
2           and ICC data to different frequency sub-bands of the corresponding FD signals.

1           30.     (currently amended) The invention of claim [[26]] 21, wherein:  
2           each filter is an FD late reverberation filter adapted to generate a different FD diffuse signal from  
3           one of the FD input signals; and  
4           the configuration further comprises a further plurality of multipliers adapted to scale the FD  
5           diffuse signals to generate a plurality of scaled FD diffuse signals, wherein the combiners are adapted to  
6           combine the scaled FD diffuse signals with the scaled, delayed FD signals to generate the synthesized FD  
7           signals.

1           31.     (original) The invention of claim 30, wherein at least two FD late reverberation filters  
2           have different filter lengths.

1           32.     (original) The invention of claim 30, wherein:  
2           the FD diffuse signals are scaled based on ICLD and ICC data;  
3           the at least one input channel is at least one combined channel generated by performing BCC  
4 coding on an original auditory scene; and  
5           the ICLD and ICC data are cue codes derived during the BCC coding of the original auditory  
6 scene.

1           33.     (original) The invention of claim 32, wherein the configuration applies different ICLD  
2 and ICC data to different frequency sub-bands of the corresponding FD signals.

1           34.     (original) The invention of claim 21, wherein the apparatus is adapted to generate more  
2 than two output channels from the at least one TD input channel.

1           35.     (original) The invention of claim 34, wherein the apparatus is adapted to synthesize a  
2 surround sound auditory scene.

1           36.     (original) The invention of claim 34, wherein the apparatus is adapted to use a single  
2 input channel to synthesize the auditory scene.

1           37.     (original) The invention of claim 21, wherein the apparatus comprises one filter for  
2 every output channel in the auditory scene.

1           38.     (original) The invention of claim 21, wherein each filter has a substantially random  
2 frequency response with a substantially flat spectral envelope.

1           39.     (original) The invention of claim 21, wherein:  
2           the apparatus is adapted to generate, combine, and convert for TD input channel frequencies less  
3 than a specified threshold frequency; and  
4           the apparatus is further adapted to apply alternative auditory scene synthesis processing for TD  
5 input channel frequencies greater than the specified threshold frequency.

1           40.     (original) The invention of claim 39, wherein the alternative auditory scene synthesis  
2 processing involves coherence-based BCC coding without the filters that are applied to the TD input  
3 channel frequencies less than the specified threshold frequency.

1           41.     (new) A method for synthesizing an auditory scene, comprising:  
2           processing at least one input channel to generate two or more processed input signals;  
3           filtering the at least one input channel to generate two or more diffuse signals; and  
4           combining the two or more diffuse signals with the two or more processed input signals to  
5           generate a plurality of output channels for the auditory scene, wherein:  
6                     the method generates more than two output channels from the at least one input channel;  
7           and  
8                     the method synthesizes a surround sound auditory scene.

1           42.     (new) The invention of claim 41, wherein a single input channel is used to synthesize  
2           the auditory scene.

1           43.     (new) A method for synthesizing an auditory scene, comprising:  
2           processing at least one input channel to generate two or more processed input signals;  
3           filtering the at least one input channel to generate two or more diffuse signals; and  
4           combining the two or more diffuse signals with the two or more processed input signals to  
5           generate a plurality of output channels for the auditory scene, wherein:  
6                     the method applies the processing, filtering, and combining for input channel frequencies  
7           less than a specified threshold frequency; and  
8                     the method further applies alternative auditory scene synthesis processing for input  
9           channel frequencies greater than the specified threshold frequency.

1           44.     (new) The invention of claim 43, wherein the alternative auditory scene synthesis  
2           processing involves coherence-based BCC coding without the filtering that is applied to the input  
3           channel frequencies less than the specified threshold frequency.

1           45.     (new) Apparatus for synthesizing an auditory scene, comprising:  
2           a configuration of at least one time domain to frequency domain (TD-FD) converter and a  
3           plurality of filters, the configuration adapted to generate two or more processed FD input signals and two  
4           or more diffuse FD signals from at least one TD input channel;  
5           two or more combiners adapted to combine the two or more diffuse FD signals with the two or  
6           more processed FD input signals to generate a plurality of synthesized FD signals; and  
7           two or more frequency domain to time domain (FD-TD) converters adapted to convert the  
8           synthesized FD signals into a plurality of TD output channels for the auditory scene, wherein:

9                   the configuration comprises:  
10                   a first TD-FD converter adapted to convert the at least one TD input channel into  
11 a plurality of FD input signals;  
12                   a plurality of delay nodes adapted to delay the FD input signals to generate a  
13 plurality of delayed FD signals; and  
14                   a plurality of multipliers adapted to scale the delayed FD signals to generate a  
15 plurality of scaled, delayed FD signals;  
16                   the delay nodes are adapted to delay the FD input signals based on inter-channel time  
17 difference (ICTD) data; and  
18                   the multipliers are adapted to scale the delayed FD signals based on inter-channel level  
19 difference (ICLD) and inter-channel correlation (ICC) data.

1           46.     (new) The invention of claim 45, wherein:  
2           the at least one input channel is at least one combined channel generated by performing binaural  
3 cue coding (BCC) on an original auditory scene; and  
4           the ICTD, ICLD, and ICC data are cue codes derived during the BCC coding of the original  
5 auditory scene.

1           47.     (new) The invention of claim 45, wherein the configuration is adapted to apply different  
2 ICTD, ICLD, and ICC data to different frequency sub-bands of the corresponding FD signals.

1           48.     (new) Apparatus for synthesizing an auditory scene, comprising:  
2           a configuration of at least one time domain to frequency domain (TD-FD) converter and a  
3 plurality of filters, the configuration adapted to generate two or more processed FD input signals and two  
4 or more diffuse FD signals from at least one TD input channel;  
5           two or more combiners adapted to combine the two or more diffuse FD signals with the two or  
6 more processed FD input signals to generate a plurality of synthesized FD signals; and  
7           two or more frequency domain to time domain (FD-TD) converters adapted to convert the  
8 synthesized FD signals into a plurality of TD output channels for the auditory scene, wherein:  
9           the apparatus is adapted to generate more than two output channels from the at least one  
10 TD input channel; and  
11           the apparatus is adapted to synthesize a surround sound auditory scene.



1           49.     (new) The invention of claim 48, wherein the apparatus is adapted to use a single input  
2 channel to synthesize the auditory scene.

1           50.     (new) Apparatus for synthesizing an auditory scene, comprising:  
2 a configuration of at least one time domain to frequency domain (TD-FD) converter and a  
3 plurality of filters, the configuration adapted to generate two or more processed FD input signals and two  
4 or more diffuse FD signals from at least one TD input channel;  
5 two or more combiners adapted to combine the two or more diffuse FD signals with the two or  
6 more processed FD input signals to generate a plurality of synthesized FD signals; and  
7 two or more frequency domain to time domain (FD-TD) converters adapted to convert the  
8 synthesized FD signals into a plurality of TD output channels for the auditory scene, wherein each filter  
9 has a substantially random frequency response with a substantially flat spectral envelope.

1           51.     (new) Apparatus for synthesizing an auditory scene, comprising:  
2 a configuration of at least one time domain to frequency domain (TD-FD) converter and a  
3 plurality of filters, the configuration adapted to generate two or more processed FD input signals and two  
4 or more diffuse FD signals from at least one TD input channel;  
5 two or more combiners adapted to combine the two or more diffuse FD signals with the two or  
6 more processed FD input signals to generate a plurality of synthesized FD signals; and  
7 two or more frequency domain to time domain (FD-TD) converters adapted to convert the  
8 synthesized FD signals into a plurality of TD output channels for the auditory scene, wherein:  
9 the apparatus is adapted to generate, combine, and convert for TD input channel  
10 frequencies less than a specified threshold frequency; and  
11 the apparatus is further adapted to apply alternative auditory scene synthesis processing  
12 for TD input channel frequencies greater than the specified threshold frequency.

1           52.     (new) The invention of claim 51, wherein the alternative auditory scene synthesis  
2 processing involves coherence-based BCC coding without the filters that are applied to the TD input  
3 channel frequencies less than the specified threshold frequency.